Overview of Measurements and Testing for Information Technology (IT)

NIST Workshop on
Advancing Measurements and Testing for Information Technology (IT)

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Michael D. Hogan
Information Technology Laboratory
National Institute of Standards and Technology
x2926 m.hogan@nist.gov

Background

- MEL/ITL Task Group on Metrology for Information Technology (IT), - formed May, 1996
- Charged with developing a white paper on IT metrology
- NIST white paper, NISTIR 6025, Metrology for Information Technology (IT), published May, 1997
- NISTIR 6025 disseminated and briefed widely inside and outside of NIST

NISTIR 6025

http://www.nist.gov/itl/lab/nistirs/ir6025.htm

- White paper suggests
  - a scope and conceptual basis for IT metrology
  - a taxonomy for IT methods of testing
  - status of IT testing and measurement
  - opportunities to advance IT metrology
  - overall roles for NIST
- White paper recapitulates importance of IT metrology to U.S.

Definitions
Information Technology (IT)

- Information Technology (IT) is a relatively recently coined term for referring to several industry sectors whose boundaries are increasingly fuzzy: computing, telecommunications, and entertainment.

- A generic, functional definition of IT is the storage, processing, transfer, display, management, organization, and retrieval of information.

Definitions
Information Technology

- The NIST Laboratory Mission is to promote the U.S. economy and public welfare through technical leadership and participation in the development of the nation's measurement and standards infrastructure.
- From this perspective, the NIST Information Technology Laboratory (ITL) has defined IT as:

> Information technology is the body of methods and tools by which communications and computing technologies are applied to acquire and transform data, and to present and disseminate information to increase the effectiveness of the modern enterprise.

Definitions
Metrology

- The definition of the term “metrology” in the *International Vocabulary of Basic and General Terms in Metrology* (the VIM) is:

  metrology

  science of measurement

- The VIM further notes that metrology includes all aspects both theoretical and practical with reference to measurements, whatever their uncertainty, and in whatever fields of science or technology they occur.

Definitions
Standards

- The term “standard,” while perhaps unavoidable, must be used carefully.
- In English, it has two relevant meanings: as a specification (what is called “norme” in French) and as the reference realization of the unit of a quantity (what is called “étalon” in French).
- The VIM definition for the latter term is:

(measurement) standard

étalon

material measure, measuring instrument, reference material or measuring system intended to define, realize, conserve or reproduce a unit or one or more values of a quantity to serve as a reference

Definitions
Measurement versus Testing

- The VIM definition for measurement is:
  - Set of operations having the object of determining a value of a quantity
- The ISO/IEC Guide 2 definitions are:
  - testing - action of carrying out one or more tests
  - tests - technical operation that consists of the determination of one or more characteristics of a given product, process or service according to a specified procedure
- NISTIR 6025 uses these terms as rough equivalents
- Others distinguish that testing is a measurement together with a comparison to a specification
- The source documents (i.e., VIM and ISO/IEC Guide 2) are silent on this

Taxonomy of Testing or Measuring

- Calibration (VIM)
  - Reference Material (VIM)
- Inspection (ISO/IEC Guide 2)
- Reference data (Task Group)
- Conformance Testing (ISO/IEC Guide 2)
  - Reference Implementation (Task Group)
- Interoperability Testing (Task Group)
  - Reference Implementation (Task Group)

Definitions
Lack of Recognized Definitions for Key Terms

- **Reference data** - In physical metrology, reference data is quantitative information, related to a measurable physical or chemical property of a substance or system of substances of known composition and structure, which is critically evaluated as to its reliability.

  In information technology, reference data is any data used as a standard of evaluation for various attributes of performance. (Task Group)
- **Interoperability testing** - The testing of one implementation (product, system) with another to establish that they can interwork. (Task Group)
- **Reference implementation** - Implementation whose attributes and behavior are sufficiently defined by standard(s), tested by certifiable test method(s), and traceable to standard(s) that the implementation may be used for assessment of a measurement method or the assignment of test methods values. (Task Group)

Opportunities in IT Metrology

- Advancing the state-of-the-art
  - level of confidence in test results
  - interoperability testing
  - automatic generation of test code
  - need for IT dimensioning or description system(s)
  - software metrics
  - algorithm testing
- All of the above depend upon advancing the mathematical, computational, and statistical sciences of IT metrology